

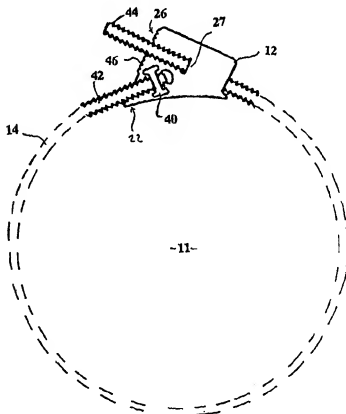


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The present invention provides a securing device comprising a toothed strap (14) having a first and second end (42, 44), and a separate non-integral head (12) for holding the strap in a closed loop. The head comprises a first pair of jaws (22) having teeth for engaging the teeth of the first end of the strap and means (40) for securing the first pair of jaws together to prevent them opening to release the first end of the strap. The head further comprises a second pair of jaws (26) having teeth for engaging the teeth of the second end of the strap to hold the strap in a closed loop, the arrangement being such that the inter-engagement of the teeth on the strap with the teeth on the second pair of jaws prevents the second end of the strap from being pulled length-wise from between the second pair of jaws to open the loop.



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Fastening or Securing Devices

Technical Field

The present invention relates to fastening or securing devices for example hose clips, hose clamps, securing bands, bundling straps and straps for securing signs.

5

Background Art

Integrally formed hose clips are well known that include a strap or band, at one end of which there is a pair of toothed jaws and at the other end of which there is a toothed tongue that can be inserted between the jaws to form the strap into a closed loop around an object, for example a hose. The tongue can be inserted into the jaws sufficiently to compress the hose and therefore keep it, for example, on a spigot. Hose clips of this type are disclosed in UK Patent No. 1,600,601. Such clips are manufactured by injection moulding.

One disadvantage of the above type of hose clip is that the range of diameters of hoses that can be clamped by any one clip is limited and it is usually necessary to provide a series of clip sizes, each size corresponding to a range of hose diameters that it can clamp. Since each clip size will need a separate injection-moulding tool, the tooling costs can be high, particularly for clips intended for relatively large diameter hoses, which in any case are used less frequently than clips for smaller diameter hoses. Also, the cost of holding a stock of a large range of clip sizes is high.

Bundling straps and ties are also known consisting of a head and an integrally-formed toothed band; the toothed band is passed around the objects being bundled and the end of the band is inserted into an opening in the head and the band is pulled through the head sufficiently to secure the bundle of objects together. The arrangement of the head is such that it engages with the teeth on the band to prevent the band being pulled backwards out of the head to release the bundled objects. One disadvantage of this arrangement is that, in order to release the bundled objects, the band must be cut. Therefore, the arrangement is not re-useable. Also, such straps must be made in a variety of sizes using several injection moulds to secure objects of differing diameters.

Alternatively, if the band is of fixed length, it is not possible to use it to secure objects having a perimeter length longer than the length of the band.

Such bundling straps can also be used for securing and closing bags and sacks.

5 Disclosure of Invention

According to the present invention, there is provided a securing device comprising:

 a toothed strap having a first end and a second end;

 a head for holding the strap in a closed loop, which head is not integral with the strap and comprises:

10 a first pair of jaws having teeth for engaging teeth on the strap for retaining the first end of the strap; and

 a second pair of jaws having teeth for engaging teeth at the second end of the strap to retain the second end of the strap and hold strap in a closed loop, the arrangement being such that the inter-engagement of the teeth on the strap with

15 the teeth of the second pair of jaws prevents the second end of the strap from being pulled lengthwise from between the second pair of jaws to open the loop and

 means for securing the first jaws together to prevent them opening to release the first end to the strap.

20

Since the strap can be of uniform cross section, it can be formed, e.g. by extrusion, in long lengths and a strap for a particular application of the desired length can be cut from it. Thus the strap can be any desired length.

25

Preferably, the first pair of jaws have teeth for engaging teeth on the strap for retaining the first end of the strap, the first pair of jaws being open at one side to allow the teeth of the strap to be engaged with the jaws by sliding the first end to the strap sideways through the open side of the first pair of jaws.

In a preferred embodiment, teeth are provided on opposed sides of the strap; the teeth on one side of the strap may each have a sloping front face and a rear face that is either

perpendicular to the axis of the strap or is inclined at an angle to the axis of the strap and slopes in the same general direction from base to tooth tip as the front face (i.e. in the latter case, the teeth are barbed). The teeth on opposed side of the strap preferably each have a front face and a rear face that are both generally perpendicular to the axis of the strap.

5

In a further preferred embodiment, the teeth on both sides of the strap each have a front face and a rear face that are both generally perpendicular to the axis of the strap.

10

Although the head of the device of the present invention may have to be injection moulded, it can be used in connection with any length of straps so that it is not necessary to make separate injection moulds for each diameter of object to be encircled.

Brief Description of Drawings

15

Figure 1 shows a side view of the head of the device of the present invention;

Figure 2 shows the head of Figure 1 viewed from the direction of the arrow "A";

Figure 3 is a cross sectional view of the head of Figures 1 and 2 taken along the line 3-3 shown in Figure 2;

20

Figure 4 is a side view of a part of a strap of the device of the present invention;

Figure 5 is a side view of a means for clamping the first jaws of the device of the present invention;

Figure 6 is a side view of the device of the present invention with the strap being engaged in the head to form a closed loop;

25

Figure 7 is an isometric view of the device of Figure 6 as seen from above and to one side but with only part of the strap being shown for reasons of clarity;

Figure 8 shows an isometric view of the device of Figure 6 as seen from one side of the device but with only part of the strap being shown for reasons of clarity.

Figure 9 is an isometric view of part of a further type of strap of a device of the present invention;

Figure 10 is a side view of the head of a device of the present invention that is

used in conjunction with the strap shown in Figure 9; and

Figure 11 is a side view of a device of the present invention with a further strap being engaged in a further head.

Description of the Preferred Embodiments

5 Referring firstly to Figure 6, there is shown a device of the present invention including head 12 and a toothed band or strap 14. The teeth are provided on the upper and lower flat surfaces of the strap 14; in Figure 6, the teeth are only shown at the two ends of the strap, for ease of illustration. The strap is formed into a closed loop and the first and second ends 42, 44 are engaged in first and second jaws 22 and 26 of the head. By
10 pulling on the second end 44 of the strap, the device can be tightened on the object or objects being clamped (shown generally by the reference number 11 in Figure 6); if the object 11 is a hose pushed onto a spigot, the device will hold the hose on the spigot. If the object 11 is a bundle of objects, e.g. electrical cables, the device will hold the cables in a tight bundle. If the object is a collection of two or more articles that are to be
15 secured together, then they will be tightly secured by the device.

Referring now to Figure 4, there is shown a side view of the strap 14 showing the teeth 16 in greater detail. The teeth each have a barbed shape with a forwardly sloping front surface 18 and a forwardly sloping rear surface 20. The strap may be formed by
20 extrusion or injection moulding in long lengths, e.g. in excess of 1 metre, and can be cut to any desired length to provide a clamp that can encircle the required object or objects.

The head 12 is shown in Figures 1 to 3, 7 and 8 and includes the first and second pairs
25 of jaws 22 and 26 respectively having teeth 24 and 28 each having a profile that is complimentary to the profile of teeth 16 on the strap 14 so that the teeth on the first and second jaws can inter-engage with the teeth 16 on the strap 14.

A passage 30 is provided in the head extending between the back of the jaws 26 and a rear face 32 of the head (see Figures 2 and 3).

The first pair of jaws 22 is open at one side (the side shown nearest the observer in Figure 1) and is closed at the other side by a wall 34, see in particular Figure 8. An I-shaped recess 39 is provided at the open side 37 of the first jaws and extends part of the way through the jaws. The depth of the recess 39 is shown by the distance "I" in Figure 8. A correspondingly shaped insert 40, which is shown enlarged in Figure 5, may be inserted into the recess 39 and so hold the first pair of jaws together.

In order to secure the device around an object, the first end 42 of the strap 14 (see Figure 6) is inserted through the open side 37 of the first pair of jaws. The inert 40 is then pushed into the recess 39 to hold the first pair of jaws together. The strap 14 is then bent around the object being clamped and the second end 44 of the strap is fed into the passage 30 in the back face 32 of the head 12 and is pushed through until it engages the teeth 28 of the second pair of jaws 26.

The second end 44 of the strap can be pushed further to the left, as viewed in Figure 6, into the space between the second pair of jaws since the leading front face 18 of the teeth 16 on the strap will engage with the teeth 28 on the second jaws and so push the second jaws apart, which will flex around the bridging region 27 between the jaws. In this way, the teeth on the strap can be pushed past successive teeth 28 on the second jaws until the second end 44 of the strap extends beyond the second pair of jaws 26, as shown in Figure 6. Then the second end may be grasped and the strap can readily be pulled in the left hand direction (as viewed in Figure 6) through the second pair of jaws 26 to tighten the strap on the object or objects being encircled.

The head 12 is made of a tough but resilient material, for example nylon or fibreglass-filled nylon so that the second pair of jaws 26 can flex to open when the strap is pulled from right to left as viewed in Figure 6. The rear surfaces 20 of the teeth of the strap and the corresponding surface of the teeth of the second jaws prevent the strap from being pulled, e.g. by tension in the strap, back through the jaws (i.e. in the direction left to right as viewed in Figure 6); this mechanism is further described in UK Patent No. 1,600,601.

However, the same mechanism and arrangement of tooth shape that allows the second end 44 of the strap to be pulled through passed the second pair of jaws also means that the first end 42 of the strap can readily be pulled out from between the teeth of the first pair of jaws. In order to avoid this and to hold the first end 42 of the strap between the first pair of jaws, the first pair of jaws are prevented from opening by the wall 38 on one side of the jaws and by the I-shaped insert 40 engaged within the recess 39 on the other side of the jaws.

As indicated, the strap 14 may be tightened around the object being clamped by gripping the second end 44 of the strap and pulling. Alternatively, a tool (not shown) may be used for gripping the second end and pulling it out from the head 12; the tool may also abut against the surface 46 of the head 12 to enable the tool to pull the first end 44 of the strap through the head 12.

Because of the shape of the teeth, the force between the second pair of jaws 26 holding the second end 44 of the strap and preventing it from being pulled back through the head 12 is exceptionally strong.

The device can be released by removing the insert 40 from within the recess 39, whereupon the tension in the strap will pull the strap from between the first jaws 22. The strap can be pulled through the second jaws 26 by pulling on the second end 44 of the strap to release the strap from the head.

The insert may be attached to the head by an integral flexible tie (not shown), in which case, the head and the tie can be made in a single injection mould. The cross pieces 48 of the I-shaped insert need not be parallel but may converge slightly in the inwards direction, i.e. towards the leading face of the insert as it is pushed into the recess; as viewed in Figure 5, the cross pieces will converge in the direction away from the observer. With such an arrangement, the taper between the cross-pieces tends to force the insert 40 further into the recess 39 as tension in the strap tries to force the first jaws apart, thereby preventing accidental release of the strap.

Teeth on the inside of the strap 14 can bite into the object 11 being clamped; in order to avoid this, a resilient pad (not shown) may be placed between the strap and the object. Alternatively, the teeth could be provided on only one side of the strap but this would lead to a much weaker bond between the strap and the head.

- 5 According to a further embodiment that is shown in connection with Figures 9 and 10, the strap 14 has barbed teeth 16 on one face, as previously described. However, on the underneath, the teeth 70 have a square or rectangular profile. The teeth in the first and second pairs of jaws 22 and 26 are correspondingly shaped. The square teeth are intended to form the inside of the closed loop 11 while the outer face of the loop is made up with the barbed teeth 16. Accordingly, it is the lower jaw of both sets of jaws 10 22 and 26 that has square-profile teeth while the upper set of teeth on the sets of jaws 22, 26 have barbed shapes.

- There are two advantages in the arrangement shown in Figures 9 and 10. Firstly, the sharp points of the barbed teeth on the inside of the band shown in Figure 6, for example, will bite into the article being clamped. This biting action is reduced by the use of the blunt square-profile teeth. Secondly, and more importantly, the perpendicular faces of the square-profile teeth add greatly to the strength of the bond between the strap 14 and the first set of jaws 22. In the arrangement shown in Figure 6, the front face 18 of the teeth in the strap are sloping in such a direction as to aid the removal of the strap from the first jaws 22 by the tension in the strap. With the strap shown in Figure 9, on the other hand, the front faces 72 of the teeth engaged with the corresponding teeth of the lower jaw of the first pair of jaws 22 are upright and not sloping and so the teeth engage each other and assist in preventing the tension in the strap from pulling the strap from between the first set of jaws 22. Likewise, the rear faces 74 of the teeth 70 also assist in preventing the second end 44 of the strap from being pulled from between the second pair a jaws 26. Thus, the square profile teeth will increase the strength of the overall device.

In the embodiment shown in Figures 1 to 8, the sloping front face 18 will, as already described, assist the strap being pulled through the second set of jaws 26 since the front

faces will force the second jaws apart as the strap is pulled through and therefore the teeth of the strap will not catch on the teeth of the jaws as the second end of the strap is pulled through the second set of the teeth 26. However, it will be apparent that the square shape of the inner set of teeth shown in Figures 9 will make it harder for the second end of the strap to be pulled lengthways through the second pair of jaws 26. since the faces 72, will catch against the corresponding teeth of the lower jaw of jaw set.

However, because the upper jaw of the second set of jaws is flexible in nature, the second end 44 can be pulled through the second set of jaws by pulling the end in the direction of arrow A shown in Figure 10; by pulling in this direction, the top jaw 78 of the second set of jaws is lifted so that the square profile teeth 70 on the bottom of the strap do not engage the square teeth on the lower jaw 80 on the second set of jaws 26. It will be appreciated that, because of the sloping nature of the teeth 16 on the outer (upper) face of the strap, the second jaw 78 will rise over the barbed teeth 16 of the strap to allow the second end of the strap to be pulled readily through the second set of jaws.

According to a further embodiment, which is shown in connection with Figure 11, square or rectangular shaped teeth 70' are provided on both the upper and lower surfaces of strap 14. Both the lower and upper jaws of the first pair of jaws 22 are provided with teeth 80 that are correspondingly shaped. However, both the upper and lower jaws of the second pair of jaws 26 have barbed teeth 28.

This arrangement has several further advantages over the arrangement shown in Figures 9 and 10. Firstly, the strength of the bond between strap 14 and the first pair of jaws 22 is increased further. Secondly, the sloping rear face of teeth 28 of both the upper and lower jaws of the second pair of jaws 26 will make it easier for the second end 44 of the strap to be pulled through the second pair of jaws 26. since the teeth 70' of the strap will not catch on the teeth 28 of second jaws 26 as the second end 44 of the strap is pulled from right to left through jaws 26. Thirdly, this arrangement allows the strap to be bent around sharp corners without fracture because the use of square teeth reduces

the stress in the strap at the base of the teeth as compared to the case when the teeth are barbed, where there is an acute angle between the bases of successive teeth.

Modifications to the clip shown in the drawings are, of course possible; for example the end 44 could be so formed that the tip of a screwdriver can engage both the end 44 of the strap and the head 12 and so lever the end of the strap through the jaws and so tighten the strap.

It is conjectured that a reel of strap material and a collection of heads 12 will be provided to a user, who will cut off a sufficient length of strap 14 from the reel to encircle the object being clamped and in this way the user does not have to keep a range of clips of different sizes in stock and the manufacturer needs only two forming dies to make the device, one for the strap and one for the head/insert.

The device can be used wherever objects have to be secured, clamped, bundled, held or tied together. For example, it could be used to close bags, to secure scaffold sheeting onto scaffolding, to bundle pipes or cables together, in packaging, as a hose clip or for securing signs to posts.

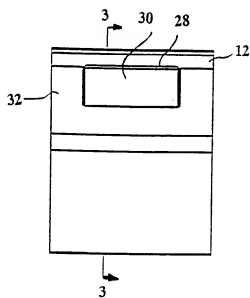
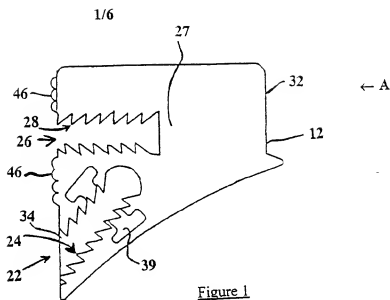
CLAIMS

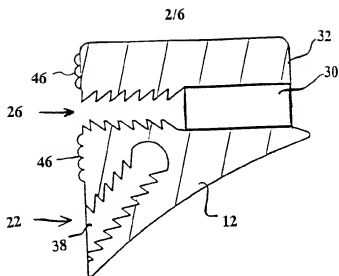
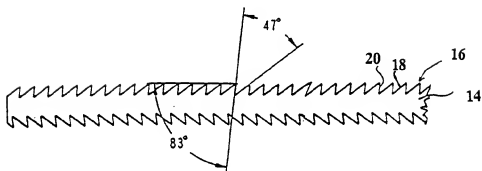
1. A securing device comprising:
a toothed strap (14) having a first end and a second end;
a head (12) for holding the strap in a closed loop, which head is not integral
5 with the strap and comprises:
a first pair of jaws (22) having teeth for engaging teeth (16, 70) on the
strap for retaining the first end of the strap;
a second pair of jaws (26) having teeth for engaging teeth (16, 70) at the
second end of the strap to retain the second end of the strap and hold
10 strap in a closed loop, the arrangement being such that the inter-
engagement of the teeth on the strap with the teeth of the second pair of
jaws prevents the second end of the strap from being pulled lengthwise
from between the second pair of jaws to open the loop; and
means (40) for securing the first jaws together to prevent them opening
15 to release the first end to the strap.
2. A device according to claim 1 wherein the strap (14) is of uniform cross-
section.
- 20 3. A device according to claim 1 or claim 2, wherein said first pair of jaws (22)
are open at one side to allow the teeth of the strap (14) to be engaged with the
jaws by sliding the first end to the strap sideways through the open side (37) of
the first pair of jaws.
- 25 4. A device as claimed in claim 3, wherein the first pair of jaws is closed at the
side (38) opposed to the open side (37) and the means for securing the first
jaws (40) engages the open side (37) of the first jaws.
5. A device as claimed in claim 3 or 4, wherein the securing means (40) is a
profiled insert that can be inserted into a correspondingly shaped recess (39) in
the first pair of jaws.

6. A device as claimed in claim 5 wherein the insert has a pair of ends (48) that converge in one direction, whereby tension in the strap (14) tending to force the first jaws (22) apart also tends to urge the insert (40) into the corresponding recess (39).
- 5 7. A device according to any one of claims 1 to 6, wherein teeth (16, 70) are provided on opposed sides of the strap (14).
8. A device according to claim 7, wherein the teeth on one side of the strap each has a sloping front face and a rear face that is either perpendicular to the axis of the strap or is inclined at an angle to the axis of the strap and slopes in the same general direction from base to tooth tip as the front face and the teeth on the opposed side of the strap each have a front face and a rear face that are both generally perpendicular to the axis of the strap.
- 10 9. A device as claimed in claim 8, wherein the teeth (16) on the opposed side of the strap are correspondingly shaped to the teeth (16) on the said one side of the strap.
- 15 10. A device as claimed in claim 8, wherein the teeth (70) on the opposed side of the strap have rectangular profiles with front and rear faces that are substantially perpendicular to the axis of the strap.
- 20 11. A device according to claim 7, wherein the teeth (70) on the opposed sides of the strap (14) have a front face and a rear face that are both substantially perpendicular to the axis of the strap.
- 25 12. A device according to claim 11, wherein the teeth (70) on the opposed sides of the strap have rectangular profiles.
13. A device as claimed in any one of claims 1 to 12, wherein the teeth (16, 70) on

the strap and on the second pair of jaws (26) are such that the second end (44) of the strap can be pulled lengthways through the second jaws to tighten the strap but cannot be pulled lengthways through the second jaws to slacken the strap.

- 5 14. A device as claimed in claim 13, wherein the teeth (16, 70) on the strap and/or the second pair of jaws (26) have sloping faces that tend to open the second pair of jaws as the second end (44) of the strap is pulled lengthways through the second jaws to tighten the strap.
- 10 14. A device as claimed in any one of claims 1 to 13, wherein the first and second ends (42, 44) of the strap enter into the head (12) from substantially opposite directions.
- 15 15. A device as claimed in any one of claims 1 to 14, wherein the strap (14) has uniform teeth provided along the whole of its length.
16. A device as claimed in any one of claims 1 to 15, wherein the strap has been cut from a longer length of strap material.
- 20 17. A securing system comprising a plurality of heads as claimed in any one of Claims 1 to 16 and a length of strap material that is severable to make a strap as claimed in any one of claims 1 to 16.



Figure 3Figure 4

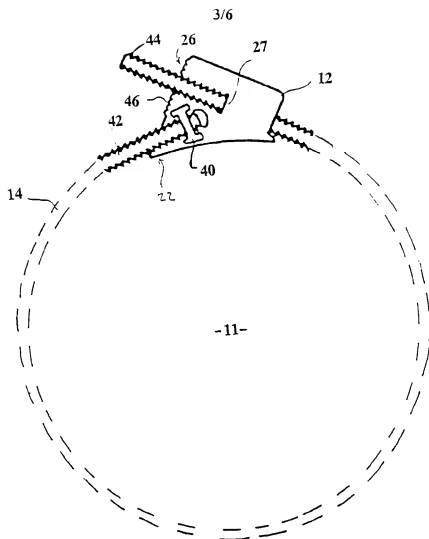


Figure 6

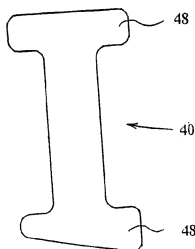


Figure 5

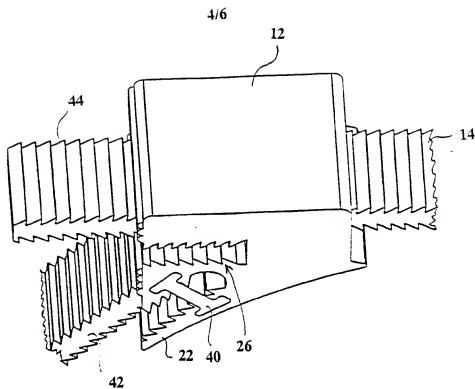


Figure 7

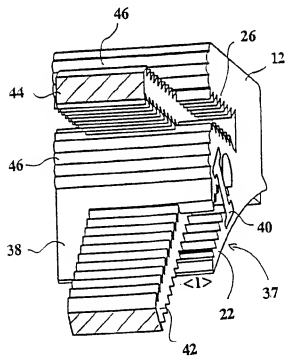


Figure 8

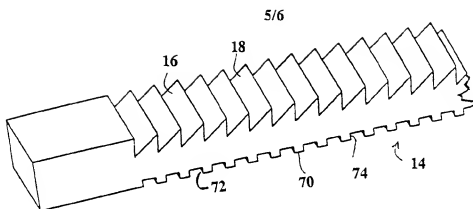


Figure 9

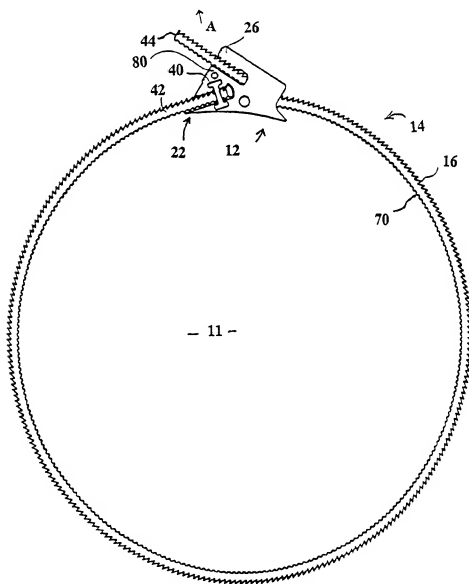


Figure 10

6/6

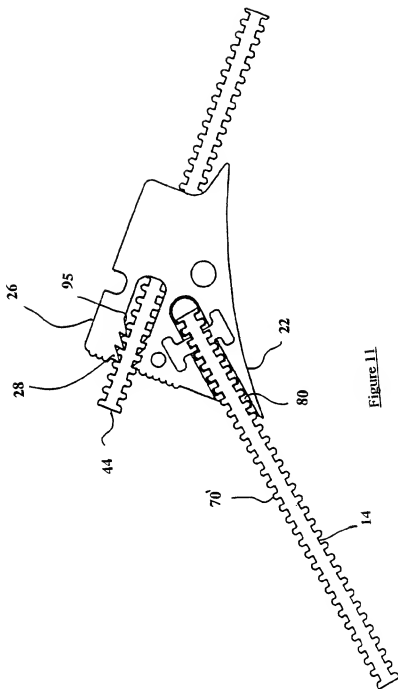


Figure 11

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GS 99/02021

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B65D63/14 F16L3/233 F16B2/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B65D F16L F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 224 244 A (KOBAYASHI SHIGEHICO ET AL) 6 July 1993 (1993-07-06) column 5, line 47 -column 6, line 2; figures 16,17 ---	1,2,7, 13-16
A	US 4 574 434 A (SHUPE JAMES T ET AL) 11 March 1986 (1986-03-11) column 4, line 1 -column 4, line 60; figure 4 ---	1,2, 12-16
A	US 3 816 878 A (ROBERTS E ET AL) 18 June 1974 (1974-06-18) column 5, line 5 -column 6, line 33; figures 10-16 --- -/-	1,14,15



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 510 650 A (ESPINOZA CESAR) 16 April 1985 (1985-04-16) column 5, line 25 -column 6, line 19; figure 3 -----	1-5,15, 16
A	US 2 653 362 A (E.R. WORKMAN) 29 September 1953 (1953-09-29) column 2, line 31 -column 2, line 49; figure 1 -----	1-3,14, 16

INTERNATIONAL SEARCH REPORT

Information on patent family members

In: ational/ Application No

PCT/GB 99/02021

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5224244	A	06-07-1993	DE	4128763 A	05-03-1992
US 4574434	A	11-03-1986	AU	4778285 A	07-03-1986
			EP	0195023 A	24-09-1986
			WO	8601180 A	27-02-1986
US 3816878	A	18-06-1974	NONE		
US 4510650	A	16-04-1985	NONE		
US 2653362	A	29-09-1953	NONE		